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Justification of the empirical laws of the anomalous dielectric relaxation in the framework of the memory function formalism

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Abstract

Using the memory conception developed in the framework of the Mori-Zwanzig formalism, the kinetic equations for relaxation functions that correspond to the previously suggested empirical functions (Cole-Davidson and Havriliak-Negami) are derived. The obtained kinetic equations contain differential operators of non-integer order and have clear physical meaning and interpretation. The derivation of the memory function corresponding to the Havriliak-Negami relaxation law in the frame of Mori-Zwanzig formalism is given. A physical interpretation of the power-law exponents involved in the Havriliak-Negami empirical expression is provided too. © 2014 Versita Warsaw and Springer-Verlag Wien.

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Keywords

Cole-Cole expression, Cole-Davidson expression, dielectric permittivity, fractal kinetics, fractals, fractional calculus operators, Havriliak-Negami expression